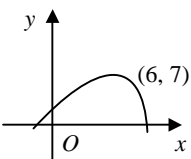
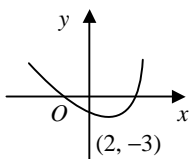
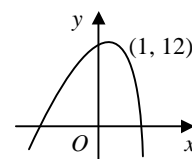
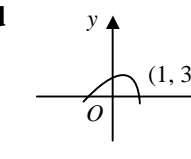


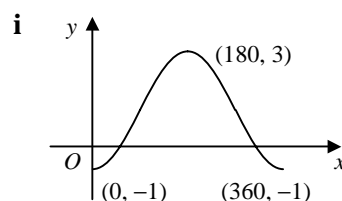
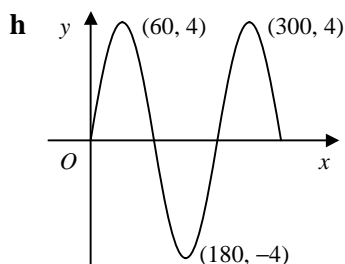
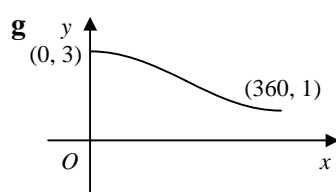
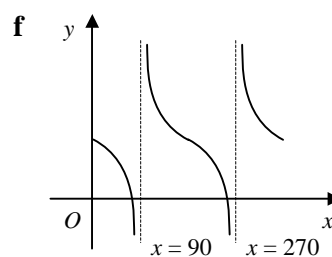
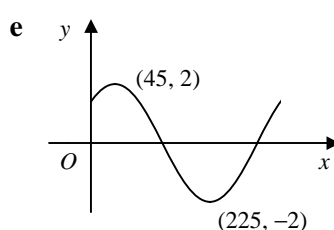
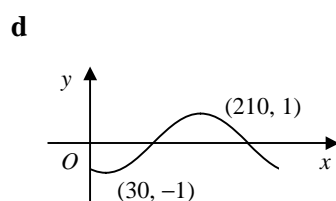
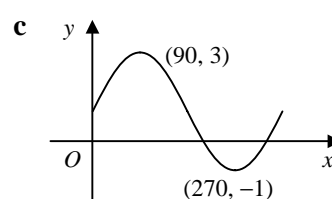
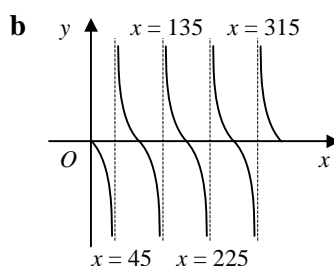
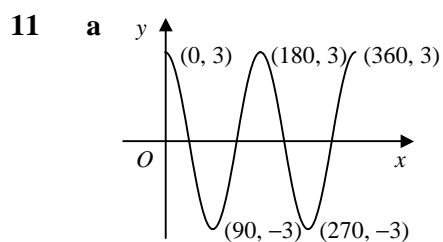
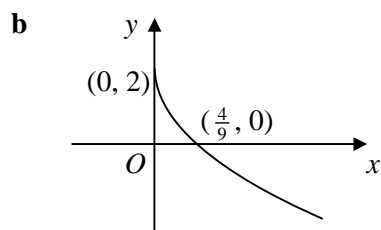
## FUNCTIONS

## Answers

**Note: For this worksheet especially, there may be alternative correct answers**

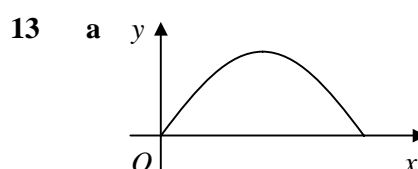
- 1**
- a** translated 3 units in negative  $x$ -direction and translated 2 units in positive  $y$ -direction
  - b** reflected in the  $y$ -axis and stretched by a factor of 2 in  $y$ -direction
  - c** translated 1 unit in positive  $x$ -direction and stretched by a factor of 3 in  $y$ -direction
  - d** reflected in the  $x$ -axis and then translated 4 units in positive  $y$ -direction
- 2**
- a**  $= (x + 3)^2 - 9 + 2 = (x + 3)^2 - 7$
  - b** translation by 3 units in negative  $x$ -direction and translation by 7 units in negative  $y$ -direction
- 3**
- a**  $y = 2[2(x - 3) + 7] \Rightarrow y = 4x + 2$
  - b**  $y = 2[3e^{(x-3)}] \Rightarrow y = 6e^{x-3}$
  - c**  $y = 2[(x - 3)^2 - 3(x - 3) + 1] \Rightarrow y = 2x^2 - 18x + 38$
  - d**  $y = 2\left[\frac{1}{(x-3)}\right] \Rightarrow y = \frac{2}{x-3}$
- 4**
- a** stretch by a factor of  $\frac{1}{3}$  in  $x$ -direction and reflection in the  $x$ -axis (either first)
  - b** reflection in the  $y$ -axis and translation by 5 units in positive  $y$ -direction (either first)
  - c** translation by 4 units in negative  $x$ -direction and stretch by a factor of 3 in  $y$ -direction (either first)
  - d** stretch by a factor of 3 in  $y$ -direction, then translation by 2 units in positive  $y$ -direction
- 5**
- a** 
  - b** 
  - c** 
  - d** 
- 6**
- first  $\Rightarrow y = (x + 2)^2 + 4(x + 2) - 2 \Rightarrow y = x^2 + 8x + 10$
  - second  $\Rightarrow y = 3[x^2 + 8x + 10] \Rightarrow y = 3x^2 + 24x + 30$
  - third  $\Rightarrow y = 3(-x)^2 + 24(-x) + 30 \Rightarrow y = 3x^2 - 24x + 30$
- 7**
- a**  $= 2[x^2 - 2x] + 7 = 2[(x - 1)^2 - 1] + 7 = 2(x - 1)^2 + 5$
  - b** translation by 5 units in negative  $y$ -direction, then stretch by a factor of  $\frac{1}{2}$  in  $y$ -direction, then translation by 1 unit in negative  $x$ -direction
- 8**
- a**  $f'(x) = 3x^2 - 6x$   
 SP:  $3x^2 - 6x = 0$   
 $3x(x - 2) = 0$   
 $x = 0, 2$   
 $\therefore (0, 4)$  and  $(2, 0)$
  - b i**  $(0, -8)$  and  $(2, 0)$       **ii**  $(0, 7)$  and  $(4, 3)$       **iii**  $(2, 1)$  and  $(4, 0)$

- 9 a stretch by factor of 3 in  $y$ -direction,  
then reflection in  $x$ -axis,  
then translation by 2 units in +ve  $y$ -dir'n
- 10 a  $180^\circ$   
b  $(0, 1)$   
c  $(90, 3)$  and  $(270, 3)$



- 12 a  $60^\circ$   
b  $\frac{360^\circ}{k}$

- 14 a max. value 4  $\therefore a = 4$   
max. occurs at  $x = 45 \therefore b = 2$   
b  $(135, -4)$



- b  $(\pi, 2)$   
c  $2 \sin \frac{1}{2}x = \sqrt{2}$   
 $\sin \frac{1}{2}x = \frac{1}{\sqrt{2}}$   
 $\frac{1}{2}x = \frac{\pi}{4}, \pi - \frac{\pi}{4}$   
 $= \frac{\pi}{4}, \frac{3\pi}{4}$   
 $x = \frac{\pi}{2}, \frac{3\pi}{2}$